WHAT IS CLAIMED IS:

1. A composition for enhancing an immune response in an animal comprising:
   (a) a virus-like particle;
   (b) an immunostimulatory nucleic acid;
   wherein said immunostimulatory nucleic acid (b) is bound to said virus-like particle (a);
   (c) at least one antigen, wherein said antigen is mixed with or coupled to said virus-like particle (a); and
   (d) at least one toll-like receptor (TLR) ligand.

2. The composition of claim 1, wherein said TLR ligand (d) is mixed with said VLP.

3. The composition of any of the preceding claims, wherein said TLR ligand is selected from the group consisting of TLR1, TLR2, TLR3, TLR4, TLR5, TLR6, TLR7, TLR8, TLR9, TLR10, and TLR11.

4. The composition of any of the preceding claims, wherein said immunostimulatory nucleic acid (b) activates a TLR that is different than the TLR activated by the ligand (d).

5. The composition of any one of the preceding claims, wherein said ligand (d) is a ligand for TLR 4.

6. The composition of claim 5, wherein said ligand (d) activating a TLR 4 is selected from the group consiting of:
   (a) LPS and derivatives thereof;
   (b) Monosphoryl lipid A and derivatives thereof;
   (c) synthetic analoga of LPS:
   (d) gp96 and derivatives thereof;
   (e) heat-shock proteins; and
   (f) defensins.

7. The composition of any one of the preceding claims, wherein said immunostimulatory nucleic acid is selected from the group consisting of:

(a) ribonucleic acids;

(b) deoxyribonucleic acids,

(c) chimeric nucleic acids; and

(d) any mixtures of at least one nucleic acid of (a), (b) and/or (c).

8. The composition of claim 7, wherein said ribonucleic acid is poly-(I:C) or a derivative thereof.

9. The composition of claim 7, wherein said deoxyribonucleic acid is selected from the group consisting of:

(a) unmethylated CpG-containing oligonucleotides; and

(b) oligonucleotides free of unmethylated CpG motifs.

10. The composition of any one of claims 1 to 7 and claim 9, wherein said immunostimulatory nucleic acid is an unmethylated CpG-containing oligonucleotide.

11. The composition of claim 10, wherein said unmethylated CpG-containing oligonucleotide comprises the sequence:

$$5' X_1X_2CGX_3X_4\ 3'$$

wherein X_1, X_2, X_3, and X_4 are any nucleotide.

12. The composition of claim 10, wherein at least one of said nucleotide X_1, X_2, X_3, and X_4 has a phosphate backbone modification.

13. The composition of claim 10, wherein said unmethylated CpG-containing oligonucleotide comprises, or alternatively consists essentially of, or alternatively consists of the sequence selected from the group consisting of:

(a) TCCATGACGTTCCTGAATAAT (SEQ ID NO: 49);

(b) TCCATGACGTTCCTGACGTT(SEQ ID NO: 51);

(c) GGGGTCAACGTTGAGGGGG (SEQ ID NO: 52);

(d) GGGGGGGGGGGACGATCGTCGGGGGGGGGG (SEQ ID NO: 54); and

(e) "dsCyCpG-253" (SEQ ID NO: 59).

14. The composition of claim 10, wherein the CpG motif of said unmethylated CpG-containing oligonucleotide is part of a palindromic sequence.

15. The composition of claim 14, wherein said palindromic sequence is GACGATCGTC (SEQ ID NO: 39).

16. The composition of claim 10, wherein said unmethylated CpG-containing oligonucleotide comprises, or alternatively consists essentially of, or alternatively consists of the sequence GGGGGGGGGGGACGATCGTCGGGGGGGGGG (SEQ ID NO: 54).

17. The composition of any one of claims 10 to 16, wherein said unmethylated CpG-containing oligonucleotide contains one or more phosphorothioate modifications of the phosphate backbone or wherein each phosphate moiety of said phosphate backbone of said oligonucleotide is a phosphorothioate modification.

18. The composition of any one of the preceding claims, wherein said immunostimulatory nucleic acid, and preferably said unmethylated CpG-containing oligonucleotide, is non-covalently bound to said virus-like particle.

19. The composition of any one of the preceding claims, wherein said immunostimulatory nucleic acid, and preferably said unmethylated CpG-containing oligonucleotide, is packaged within said virus-like particle.

20. The composition of any one of the preceding claims, wherein said immunostimulatory nucleic acid, and preferably said unmethylated CpG-containing oligonucleotide (b) is enclosed by said virus-like particle (a).

21. The composition of any of claims 14 or 15, wherein said palindromic sequence is flanked at its 3'-terminus and at its 5'-terminus by 10 or less than 10 guanosine entities.

22. The composition of any of claims 14 or 15, wherein said palindromic sequence is flanked at its N-terminus by at least 3 and at most 9 guanosine entities and wherein said palindromic sequence is flanked at its C-terminus by at least 6 and at most 9 guanosine entities.

23. The composition of any of claims 14 or 15, wherein said unmethylated CpG-containing oligonucleotide has a nucleic acid sequence selected from

(a) GGGGACGATCGTCGGGGGG (SEQ ID NO: 40);
(b) GGGGGACGATCGTCGGGGGG (SEQ ID NO: 41);
(c) GGGGGGACGATCGTCGGGGGG (SEQ ID NO: 42);
(d) GGGGGGGACGATCGTCGGGGGG (SEQ ID NO: 43);
(e) GGGGGGGGACGATCGTCGGGGGGG (SEQ ID NO:44);
(f) GGGGGGGGGACGATCGTCGGGGGGGG (SEQ ID NO: 45);
(g) GGGGGGGGGGACGATCGTCGGGGGGGGG (SEQ ID NO: 46); and
(h) GGGGGGCGACGACGATCGTCGTCGGGGGGG (SEQ ID NO: 47).

24. The composition of any of claims 14 or 15, wherein said palindromic sequence is flanked at its 5'-terminus of at least 4 and at most 9 guanosine entities and wherein said palindromic sequence is flanked at its 3'-terminus of at least 6 and at most 9 guanosine entities, and preferably wherein said palindromic sequence is flanked at its 5'-terminus of at least 5 and at most 8 guanosine entities and wherein said palindromic sequence is flanked at its 3'-terminus of at least 6 and at most 8 guanosine entities.

25. The composition of any of claims 14 or 15, wherein said unmethylated CpG-containing oligonucleotide has a nucleic acid sequence of SEQ ID NO: 45.

26. The composition of any of the preceding claims, wherein said immunostimulatory nucleic acid, and preferably said unmethylated CpG-containing oligonucleotide, comprises about 6 to about 300 nucleotides, preferably about 6 to about 100 nucleotides, and even more preferably about 6 to about 40 nucleotides.

27. The composition of any of the preceding claims, wherein said immunostimulatory nucleic acid, and preferably said unmethylated CpG-containing oligonucleotide, comprises about 20 to about 300 nucleotides, preferably about 20 to about 100 nucleotides, and even more preferably about 20 to about 40 nucleotides.

28. The composition of any of the preceding claims, wherein said immunostimulatory nucleic acid, and preferably said unmethylated CpG-containing oligonucleotide, comprises about 10 to about 30 nucleotides.

29. The composition of any of the preceding claims, wherein said immunostimulatory nucleic acid, and preferably said unmethylated CpG-containing oligonucleotide, is selected from

(a) a recombinant oligonucleotide;
(b) a genomic oligonucleotide;
(c) a synthetic oligonucleotide;
(d) a plasmid-derived oligonucleotide;
(e) a PCR product;
(f) a single-stranded oligonucleotide; and
(g) a double-stranded oligonucleotide.

30. The composition of any of the preceding claims, wherein said immunostimulatory nucleic acid, and preferably said unmethylated CpG-containing oligonucleotide (b) is bound to a virus-like particle site selected from the group consisting of an oligonucleotide binding site, a DNA binding site and a RNA binding site.

31. The composition of claim 30, wherein said oligonucleotide binding site is a non-naturally occurring oligonucleotide binding site.

32. The composition of claim 30, wherein said virus-like particle site comprises an arginine-rich repeat.

33. The composition of any of the preceding claims, wherein said immunostimulatory nucleic acid (b) is an unmethylated CpG-containing oligonucleotide and wherein said ligand (d) is a ligand for TLR 1, 2, 3, 4, 5, 6, 7, 8, 10 or 11.

34. The composition of any of the preceding claims, wherein said immunostimulatory nucleic acid (b) is an unmethylated CpG-containing oligonucleotide and wherein said ligand (d) is a ligand for TLR4, preferably LPS or a derivative thereof.

35. The composition of any of claims 1 to 32, wherein said immunostimulatory nucleic acid (b) is poly (I:C), and wherein said ligand (d) is a ligand for TLR 1, 2, 4, 5, 6, 7, 8, 9, 10 or 11.

36. The composition of any of the preceding claims, wherein said immunostimulatory nucleic acid (b), and preferably said unmethylated CpG-containing oligonucleotide, contains one or more phosphorothioate modifications of the phosphate backbone or wherein each phosphate moiety of said phosphate backbone of said oligonucleotide is a phosphorothioate modification.

37. The composition of any of the preceding claims, wherein said virus-like particle (a) lacks a lipoprotein-containing envelope.

38. The composition of any one of the preceding claims, wherein said virus-like particle (a) is a recombinant virus-like particle, wherein preferably said virus-like particle is selected from the group consisting of:

(a) recombinant proteins of RNA-phages;

(b) recombinant proteins of measles virus;
(c) recombinant proteins of Sindbis virus;
(d) recombinant proteins of Rotavirus;
(e) recombinant proteins of Foot-and-Mouth-Disease virus;
(f) recombinant proteins of Retrovirus;
(g) recombinant proteins of Norwalk virus;
(h) recombinant proteins of Alphavirus;
(i) recombinant proteins of human Papilloma virus;
(j) recombinant proteins of Polyoma virus;
(k) recombinant proteins of bacteriophages;
(l) recombinant proteins of Hepatitis B virus;
(m) recombinant proteins of Qβ-phage;
(n) recombinant proteins of GA-phage
(o) recombinant proteins of fr-phage;
(p) recombinant proteins of AP 205-phage;
(q) recombinant proteins of Ty; and
(r) fragments of any of the recombinant proteins from (a) to (p).

39. The composition of any of the preceding claims, wherein said recombinant virus-like particle is the Hepatitis B virus core protein or the BK virus VP1 protein.

40. The composition of any one of claims 1 to 38, wherein said virus-like particle comprises, or alternatively consists essentially of, or alternatively consists of recombinant proteins, or fragments thereof, of a RNA-phage, wherein said RNA-phage is selected from the group consisting of:

(a) bacteriophage Qβ;
(b) bacteriophage R17;
(c) bacteriophage fr;
(d) bacteriophage GA;
(e) bacteriophage SP;
(f) bacteriophage MS2;
(g) bacteriophage M11;

(h) bacteriophage MX1;
(i) bacteriophage NL95;
(j) bacteriophage f2;
(k) bacteriophage PP7; and
(l) bacteriophage AP205

41. The composition of any one of claims 1 to 38, wherein said virus-like particle comprises recombinant proteins, or fragments thereof, of a RNA-phage, wherein said RNA-phage is bacteriophage Qβ or bacteriophage AP205.

42. The composition of any of the preceding claims, wherein said virus-like particle comprises at least one first attachment site, and wherein said antigen (c) further comprises at least one second attachment site being selected from the group consisting of:

(a) an attachment site not naturally occurring with said antigen or antigenic determinant; and
(b) an attachment site naturally occurring with said antigen or antigenic determinant;

and wherein said second attachment site is capable of association to said first attachment site.

43. The composition of claim 42 further comprising an amino acid linker, wherein said amino acid linker comprises, or alternatively consists of, said second attachment site.

44. The composition of any of the preceding claims, wherein said antigen (c) is selected from the group consisting of:

(a) polypeptides;
(b) lipoproteins; and
(c) glycoproteins.

45. The composition of any of the preceding claims, wherein said antigen (c) is a recombinant antigen.

46. The composition of any one of claims 1 to 44 wherein said antigen (c) is isolated from a natural source.

47. The composition of claim 46, wherein said natural source is selected from the group consisting of:

(a) pollen extract;
(b) dust extract;
(c) dust mite extract;
(d) fungal extract;
(e) mammalian epidermal extract;
(f) feather extract;
(g) insect extract;
(h) food extract,
(i) hair extract;
(j) saliva extract, and
(k) serum extract.

48. The composition of any one of claims 1 to 44, wherein said antigen (c) is derived from the group consisting of:

(a) viruses;
(b) bacteria;
(c) parasites;
(d) prions;
(e) tumors;
(f) self-molecules;
(g) non-peptidic hapten molecules;
(h) allergens; and
(i) hormones.

49. The composition of any one of claims 1 to 44, wherein said antigen (c) is a tumor antigen.

50. The composition of claim 49, wherein said tumor antigen is selected from the group consisting of:

(a) Her2;
(b) GD2;
(c) EGF-R;
(d) CEA;
(e) CD52;
(f) human melanoma protein gp100;
(g) human melanoma protein melan-A/MART-1;
(h) tyrosinase;
(i) NA17-A nt protein;
(j) MAGE-3 protein;
(k) p53 protein;
(l) HPV16 E7 protein;
(m) an analogue of any of the antigens from (a) to (l); and
(n) antigenic fragments of any of the tumor antigens from (a) to (m).

51. The composition of any one of claims 1 to 44, wherein said antigen (c) is an allergen.

52. The composition of claim 51, wherein said allergen is derived from the group consisting of:

(a) pollen extract;
(b) dust extract;
(c) dust mite extract;
(d) fungal extract;
(e) mammalian epidermal extract;
(f) feather extract;
(g) insect extract;

(h) food extract;

(i) hair extract;

(j) saliva extract; and

(k) serum extract.

53. The composition of claim 51, wherein said allergen is selected from the group consisting of:

(a) trees;

(b) grasses;

(c) house dust;

(d) house dust mite;

(e) aspergillus;

(f) animal hair;

(g) animal feather;

(h) bee venom;

(i) animal products; and

(j) plant products.

54. The composition of any one of claims 1 to 44, wherein said antigen (c) is selected from the group consisting of:

(a) bee venom phospholipase A_2;

(b) ragweed pollen Amb a 1;

(c) birch pollen Bet v I;

(d) white faced hornet venom 5 Dol m V;

(e) house dust mite Der p 1;

(f) house dust mite Der f 2;

(g) house dust mite Der 2;

(h) dust mite Lep d;

(i) fungus allergen Alt a 1;

(j) fungus allergen Asp f 1;

(k) fungus allergen Asp f 16; and

(l) peanut allergens.

55. The composition of any one of claims 1 to 44, wherein said antigen (c) is a cytotoxic T cell epitope, a Th cell epitope or a combination of at least two of said epitopes, wherein said at least two epitopes are bound directly or by way of a linking sequence.

56. The composition of claim 53, wherein said cytotoxic T cell epitope is selected from the group consisting of:

(a) a viral epitope;

(b) a tumor epitope; and

(c) an allergenic epitope.

57. A method for enhancing an immune response in an animal comprising introducing into said animal a composition comprising a composition of any one of claims 1 to 56.

58. The method of claim 57, wherein said animal is a mammal, preferably a human.

59. The method of claim 57, wherein said composition is introduced into said animal subcutaneously, intramuscularly, intravenously, intranasally or directly into the lymph node.

60. A vaccine comprising an immunologically effective amount of the composition of any of claims 1 to 56 together with a pharmaceutically acceptable diluent, carrier or excipient.

61. A method of immunizing or treating an animal comprising administering to said animal an immunologically effective amount of the vaccine of claim 60.

62. The method of claim 61, wherein said animal is a mammal, preferably a human.

63. Use of a composition according to any of claims 1 to 56 or use of a vaccine according to claim 60 in the manufacture of a pharmaceutical for the treatment of a disorder or disease comprising, and preferably selected from the group consisting of, allergies, tumors, chronic diseases and chronic viral diseases.

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